

CONTRIBUTION OF AREA, PRODUCTIVITY AND THEIR INTERACTION TOWARDS CHANGING OILSEEDS AND SOYBEAN PRODUCTION SCENARIO IN INDIA

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ABSTRACT

An attempt has been made to ascertain the contribution dynamics of area and productivity and their interaction to the total production of nine oilseeds and soybean utilizing the secondary data for each five year plans as well as for cumulative period till date. The results lead to conclude that the interaction of area x productivity dominantly governed the total production. The expansion in area, in general, contributed higher to production than yield. The production of nine oilseeds was contributed significantly by the increase in productivity whereas in case of soybean individual effect of productivity was not discernible to that extent. This is attributable to the continuous increase in irrigated area under nine oilseeds from 6 per cent (1970) to above 27 per cent (till date). Nearly ninety eight per cent area under soybean is still rainfed. In oilseeds including soybean, negative absolute and relative changes were observed in fifth and ninth plan periods and may be attributed to prevailing climate.

Key words: Area, Interaction, Oilseeds, Production, Productivity, Soybean

INTRODUCTION

Enhancing the productivity and production of oilseeds in India is a major challenge for the policy makers. In spite of all the efforts from the government and concerted research inputs, the country still imports about 40 per cent of edible oil from other countries investing Rs 13,000 crores each year (<http://mofpi.nic.in/ContentPage.aspx?CategoryId=687>). This makes the country third largest consumer after China and European countries (Agrawal, 2007).

It is paradoxical to learn that although India leads in area under oilseeds in the world, but ranks fourth in production after USA, China and Brazil (Murthyunjaya, 2007). This appears to be mainly on account of lower productivity consequent upon major (75 to 80 %) cultivation of these crops under rainfed conditions. Murthyunjaya (2007) analyzed that although the productivity gains in oilseeds have been positive but slow. The reported incremental productivity gain during past 40 years in case of oilseeds have been 500 kg/ha which is more than three times than pulses but 2.5 times lower than rice

(1200 kg/ha) and 4 times lower than wheat (2000 kg/ha).

The country was producing enough oilseeds to meet the domestic requirement during 1950s. On account of rapid increase in population and raised per capita consumption of edible oil, the demand and supply status started tilting towards reduced supply and increasing demand from the next very decade. The increasing expenditure on import of edible oil, although belated, alarmed the policy makers and with the result Technology Mission on Oilseeds (TMO) was launched in 1986 to make the cultivation of oilseeds more popular with research emanated technology back up. Although, the pulses and maize were included in the mission subsequently, the concerted efforts to enhance the production and productivity of oilseeds were continued in mission mode approach. The efforts under the mission paid dividends making the country again self-reliant in edible oil in early nineties (Rao, 2007). But soon after, the demand overpowered the supply and the country continued to incur increasing expenditure

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on import of oil in subsequent years. With the result, India now imports edible oil slightly less than 50 percent of its demand. To further resolve the situation, the Government of India again revamped the Mission as Integrated Scheme on Oilseeds, Pulses, Oil palm and Maize (ISOPOM) in the year 2004, the impact of which is being visible now as the productivity which use to be below one ton per ha is stabilized at above 1 t/ha in past few years.

Presently, soybean, groundnut and rapeseed-mustard are major among oilseeds cultivated in India and shares nearly 82 per cent in area and 90 per cent production (Anonymous 2011). Although soybean crop has been commercially exploited only 4 decades back in the country, it occupies premier position among oilseeds in area (36% of nine oilseeds) and production (41 % of nine oilseeds) and contributes above 22 per cent to the total edible oil produced in the country (Mistry, 2012). Even at global level, it stood (8.7 m ha) neck and neck to China (8.8 m ha) during *kharif* 2007. Since then the area continues to grow reaching 9.95 million hectares by Anonymous (2011). Soybean production is increasingly becoming vital for the country not only because it contributes significantly to national oil edible kitty but also by way of annual earnings somewhere between Rs 4000 to Rs 7600 crores through export of soya-meal. Being a cash crop it ensures instant returns and the highest profit among the competing *kharif* crops (Gautam and Nahatkar, 1993). Its potential to mitigate the wide spread energy-protein malnutrition in Indian masses and possible health benefits associated with its routine consumption in daily diet adds further flavour to its promotion for cultivation in the country.

Hence, it was considered appropriate to analyze the dynamics of area, productivity and their interaction to the total production of nine oilseeds, in general and soybean in particular. For the analysis of results, the growth during each five year plan and for the total period was considered.

MATERIALS AND METHODS

The study is based on time series secondary data (1951-52 to 2010-11) on area, production and productivity for the nine oil seeds and (1970-71 to 2011-12) for soybean (Table 1). The secondary data were grouped as per the duration of five year plan from 1951 onwards. The annual plans 1966-69,

1979-80 and 1989-91 were included in preceding third, fifth and seventh five year plans. The analysis has been taken up stepwise so as to see their performance and contribution to the total oilseed and soybean production. The absolute and relative changes in area, production and productivity were determined plan-wise. An attempt was made to examine the effect of area, productivity and their interaction on the total change in the production of nine oilseeds and soybean. The total change in production was decomposed in area effect, yield effect and their interaction effect as proposed by Gupta (1993) as given below.

Area effect (%) = $(A_n - A_0)Y_0 / P_n - P_0 \times 100$

Yield effect (%) = $(Y_n - Y_0) A_0 / P_n - P_0 \times 100$

Interaction effect (%) = $(A_n - A_0) (Y_n - Y_0) / P_n - P_0 \times 100$

Where: A_0 = Area in base year; A_n = Area in current year; P_0 = Production in base year; P_n = Production in current year; Y_0 = Yield in base year (P_0 / A_0) and Y_n = Yield in current year (P_n / A_n)

RESULTS AND DISCUSSION

Nine oilseeds: The relative increase in area, production and productivity of nine oilseeds has been 129, 518 and 170 per cent over the last 60 years (Table 2). The data on absolute and relative changes during the third and fifth plan period showed that there were a set back in area, production and productivity of oilseeds, whereas in second and ninth plan this set back was restricted to productivity, and area and production, respectively.

The decomposition analysis indicated that of the 10 five year plans so far, six (1st, 2nd, 5th, 6th, 8th and 10th plan) of them showed maximum contribution of the productivity towards production, which varied from 47.87 to 76.25 %. On the contrary, during third, fourth, seventh and ninth five year plans, the area effect dominated (49.99 to 430.25%). However, the contribution to the production from interaction effect was lesser than either area or yield. Among the different five year plans the interaction effect was highest in ninth five year plan followed by seventh and tenth five year plan periods. The second, third and fifth five year plans showed negative contribution from interaction of area and productivity to the production of nine oilseeds crops. Looking to the total 56 years data, the major contribution observed was from interaction effect of area x productivity followed by that of area and productivity individually.

TABLE 1: All India area, production and productivity of nine oilseeds and soybean since 1951

Year	Oilseeds			Soybean		
	Area (mha)	Production (mt)	Productivity (kg/ha)	Area (mha)	Production (mt)	Productivity (kg/ha)
1951-52	11.69	5.03	430	-	-	-
1952-53	11.18	4.73	424	-	-	-
1953-54	10.99	5.37	488	-	-	-
1954-55	12.52	6.40	511	-	-	-
1955-56	12.09	5.73	474	-	-	-
1956-57	12.49	6.36	509	-	-	-
1957-58	12.66	6.35	502	-	-	-
1958-59	13.00	7.30	561	-	-	-
1959-60	13.95	6.56	470	-	-	-
1960-61	13.77	6.98	507	-	-	-
1961-62	14.77	7.28	493	-	-	-
1962-63	15.34	7.39	482	-	-	-
1963-64	14.82	7.13	481	-	-	-
1964-65	15.26	8.56	561	-	-	-
1965-66	15.25	6.40	419	-	-	-
1966-67	15.00	6.43	428	-	-	-
1967-68	15.67	8.30	530	-	-	-
1968-69	14.47	6.85	473	-	-	-
1969-70	14.81	7.73	522	-	-	-
1970-71	16.64	9.63	579	0.03	0.01	426
1971-72	17.27	9.08	526	0.03	0.01	426
1972-73	15.79	7.14	452	0.03	0.03	819
1973-74	16.90	9.39	555	0.05	0.04	829
1974-75	17.31	9.15	529	0.07	0.05	768
1975-76	16.92	10.61	627	0.09	0.09	975
1976-77	16.47	8.43	512	0.13	0.12	988
1977-78	17.17	9.66	563	0.20	0.18	940
1978-79	17.71	10.10	570	0.31	0.30	975
1979-80	16.94	8.74	516	0.50	0.28	568
1980-81	17.60	9.37	532	0.61	0.44	728
1981-82	18.91	12.08	639	0.48	0.35	741
1982-83	17.76	10.00	563	0.77	0.49	637
1983-84	18.69	12.69	679	0.84	0.61	735
1984-85	18.92	12.95	684	1.24	0.95	768
1985-86	19.02	10.83	570	1.34	1.02	764
1986-87	18.63	11.27	605	1.53	0.89	584
1987-88	20.13	12.65	629	1.54	0.90	582
1988-89	21.90	18.03	824	1.73	1.55	892
1989-90	22.80	16.92	742	2.25	1.81	801
1990-91	24.15	18.61	771	2.56	2.60	1015
1991-92	25.89	18.60	719	3.18	2.49	782
1992-93	25.24	20.11	797	3.79	3.39	894
1993-94	26.90	21.50	799	4.37	4.75	1086
1994-95	25.30	21.34	843	4.32	3.93	911
1995-96	25.96	22.11	851	5.04	5.10	1012
1996-97	26.34	24.38	926	5.45	5.38	987
1997-98	26.12	21.32	816	5.99	6.46	1079
1998-99	26.23	24.75	944	6.49	7.14	1100
1999-00	24.38	20.72	853	6.22	7.08	1138
2000-01	22.77	18.44	810	6.42	5.28	822
2001-02	22.64	20.66	913	6.34	5.96	940
2002-03	21.49	14.84	691	6.11	4.65	762
2003-04	23.66	25.19	1064	6.50	7.86	1210
2004-05	27.52	24.35	885	7.46	7.51	1007
2005-06	27.86	27.98	1004	7.71	8.27	1073
2006-07	26.51	24.29	916	8.33	8.85	1063
2007-08	26.69	29.76	1115	8.88	10.97	1235
2008-09	27.56	27.72	1006	9.51	9.91	1041
2009-10	25.96	24.88	959	9.73	9.96	1024
2010-11*	26.82	31.10	1159	9.55	12.73	1325
2011-12**		30.62		9.95	12.24	1264

* Final Estimates released by Directorate of Economics & Statistics, Department of Agriculture and Cooperation, GOI as on 23.04.2012

** Third Advance Estimates released by Directorate of Economics & Statistics, Department of Agriculture and Cooperation, GOI as on 23.04.2012

TABLE 2: Relative change and area, yield and their interaction effect of area, production and productivity of nine oilseeds during different five year plans

Plan Period	Absolute change			Relative change (%)			Area effect (%)	Yield Effect(%)	Interaction effect (%)
	Area	Production	Yield	Area	Production	Yield			
1951-52 to 1955-56	0.40	0.70	44	3.42	13.92	10.23	24.57	73.48	2.51
1956-57 to 1960-61	1.28	0.62	-2	10.25	9.75	-0.39	105.08	-4.03	-0.41
1961-62 to 1968-69	-0.30	-0.43	-20	-2.03	-5.91	-4.06	34.40	54.74	-1.40
1969-70 to 1973-74	2.09	1.66	33	14.11	21.48	6.32	65.72	29.44	4.16
1974-75 to 1979-80	-0.37	-0.41	-13	-2.14	-4.48	-2.46	47.74	54.89	-1.17
1980-81 to 1984-85	1.32	3.58	152	7.50	38.21	28.57	19.62	74.73	5.64
1985-86 to 1991-92	6.87	7.77	149	36.11	71.75	26.14	50.86	36.80	13.29
1992-93 to 1996-97	1.10	4.27	129	4.36	21.23	16.19	20.53	76.25	3.32
1997-98 to 2001-02	-3.48	-0.66	97	-13.32	-3.09	11.89	430.25	-383.88	51.15
2002-03 to 2006-07	5.02	9.45	225	23.35	63.67	32.56	36.71	51.17	11.95
2007-08 to 2011-12	0.13	1.34	44	0.49	4.50	3.95	10.81	87.64	0.42
Total (60 years)	15.13	26.07	678	129.42	518.29	169.53	24.96	32.69	42.31

Soybean: Introduction of commercial cultivation of soybean to boost up oilseed production in India turned out to be a unique decision of the policy makers. In a limited time span of less than four decades, the crop which had merely 30 thousand hectares in 1970 occupies an area of 9.95 million hectares in *kharif* 2011. Scrutinizing the growth data brings out that the maximum absolute change in production was recorded during seventh, eighth and tenth plan periods. In case of absolute changes in area, the order was eighth, seventh and tenth plan periods. The maximum values of relative changes for area and production were noticed during sixth, seventh and fifth plan periods in that order. During ninth plan period, the production and productivity, both showed negative absolute and relative changes (Table 3). In addition in fifth plan period, the absolute and relative changes for yield were negative. During fourth plan period, maximum values for absolute and relative changes for productivity only were recorded.

Since soybean cultivation was picked up only from 4th plan onwards, from fifth to eighth plan the area effect was dominant. This appears to be on account of introductory phase of the crop which involved acquaintance of soybean growers with crop

cultivation. This requires mention here that during initial years, the horizontal expansion of the crop was confined to Vertisol and associated soils of Madhya Pradesh having nearly 4 m ha as monsoon fallows (Williams *et al.*, 1974). Subsequently during ninth plan period was set back for area expansion as consecutive three years *viz* 2000, 2001 and 2002, experienced uneven and delayed monsoon in the major soybean growing region. The area reduction was not on account of occupation by other crops but as the area could not be sown for this rainfed crop. This is being the reason of reoccupying of area under the command of soybean during tenth plan. However, productivity effect on total production was dominant in fourth, ninth and tenth plan periods. Cumulative effect for 60 years precisely brought out that interaction of area x yield was dominant (66 %) on total production. However, at individual level contribution of area on production was 34 % whereas that of productivity was 0.20 %. The contribution as observed above corroborates the earlier reports by Billore and Joshi (1998) and Nahatkar *et al.* (2005).

Nine oil seeds *viz a viz* soybean: Comparison of the nine oilseeds with soybean during fourth plan to

TABLE 3: Relative change and area, yield and their interaction effect of area, production and productivity of soybean during different five year plans

Plan Period	Absolute change			Relative change (%)			Area effect (%)	Yield effect (%)	Interaction effect (%)
	Area	Production	Yield	Area	Production	Yield			
1970-71 to 1973-74	0.02	0.03	403	66.67	300.00	94.60	28.40	40.30	26.87
1974-75 to 1979-80	0.43	0.23	-200	614.29	460.00	-26.04	143.58	-6.09	-37.91
1980-81 to 1984-85	0.63	0.51	40	103.28	115.91	5.49	89.93	4.78	4.94
1985-86 to 1991-92	1.84	1.47	18	137.31	144.12	2.35	95.63	1.64	2.25
1992-93 to 1996-97	1.66	1.99	93	43.80	58.70	10.40	74.58	17.71	6.87
1997-98 to 2001-02	0.35	-0.50	-139	5.84	-7.74	-12.88	-75.53	166.52	9.73
2002-03 to 2006-07	2.22	4.20	301	36.33	90.32	39.50	40.28	43.79	15.91
2007-08 to 2011-12	1.07	1.60	29	12.04	14.58	2.34	82.59	16.10	1.93
Total (60 years)	9.92	12.56	838	33066.70	125600	196.71	33.64	0.20	66.19

tenth plan periods revealed that the major contribution to the total nine oil seeds production came from productivity (5th, 6th, 8th and 10th plans) effect followed by area effect (4th, 7th and 9th plans), while in case of soybean the trend was different. The lion share to production of soybean can be attributed to expansion in cultivation area (5th to 8th plans) followed by that of productivity (4th, 9th and 10th plans). Sadeesh *et al.* (2006) reasoned that an annual increment in soybean area by 20 percent is on account of its being a major *kharif* cash crop luring farmers for cultivation. The data generated clearly brings out that the interaction effect of area x productivity followed by increasing area contributed enormously to the total production of nine oilseeds as well as that of soybean. The contribution from productivity appears to be prominent in case of nine oilseeds (29.82%), while in soybean it was only 0.22%. This behaviour is justifiable as in case of nine oilseeds the area under irrigation has been consistently build up from 6% in 1970 to above 25% as on today whereas 98 percent soybean cultivation

is rainfed (Anonymous, 2004). Moreover, the soybean crop is horizontally expanding at an unparallel pace of nearly 4 lakh hectares per annum and each increment comes mainly from the novice soybean growers of the crop.

Analysis of plan-wise and cumulative secondary data from 1951-52 to 2011-12 of nine oil seeds and soybean brings out that there has been remarkable increase in area, production and productivity of all the oilseeds during the period. Although, there has been varied contribution of area and production on productivity of oilseeds, including that of soybean from plan to plan period, the major contribution appeared to have come from the interaction of area X productivity. After interaction of area X productivity, productivity contributed to a larger extent to production in case of nine oilseeds, whereas it was area expansion for soybean. The lower contribution of productivity in case of soybean is understandable on account of its unparallel area expansion during past 42 years coupled with lower pace of productivity enhancement.

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